iBGP, OSPF and eBGP (GNS3) Lab

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Purpose

The purpose around this lab was to use the founding knowledge from previous labs creating a working topology of ibgp, ospf, and ebgp. By using loopback interfaces versus physical interfaces as the gigabit or fastethernet, the loopback interfaces would never shut down versus the physical interfaces. Also, the difference in relying on redistribution to allow access connection between ebgp and ibgp weren’t used in this lab.

Background

The Border Gateway Protocol (BGP) is a standardized exterior gateway protocol that allows autonomous systems (AS) on the Internet to share routing and reachability information. BGP is a path-vector routing protocol that makes routing decisions based on routes, network rules, or rule-sets that a network administrator configures. Interior Border Gateway Protocol, or Internal BGP, is the name of the BGP protocol used for routing within an autonomous system (iBGP). Exterior Border Gateway Protocol, or External BGP, is the name of the protocol's Internet framework (eBGP). The way routes obtained from one peer are propagated to other peers is the key difference between iBGP and eBGP peering. New routes learned from an eBGP peer, for example, are usually redistributed to all iBGP peers and all other eBGP peers (if transit mode is enabled on the router). New routes discovered on an iBGP peering, on the other hand, are only re-advertised to all eBGP peers. The loopback address can be used as the Router ID (RID) in routing protocols such as OSPF and BGP. RIDs that are clearly recognizable can be assigned by a network engineer. Adjacency is created by announcing these RIDs to the router's peers or neighbors. The loopback interface is useful because it is an IP address-based interface that is never down. OSPF can choose a Router ID on its own if no Router ID is specified. It selects the Router ID from the installed and allowed interfaces' IP addresses. A loopback gui is a smart idea since it is still on until anyone explicitly switches it off. If there is a problem with the connection, other interfaces can go down. The Idle condition is the first one. BGP initializes all resources in the idle state, rejects all inbound BGP link attempts, and establishes a TCP connection with the peer. Connect is the second condition. The router waits for the TCP connection to complete in the Link state before switching to the OpenSent state if it is successful. If the connection is lost, the ConnectRetry timer is started, and when it expires, it returns to the Active state. The router returns to the Connect state after resetting the ConnectRetry timer to zero in the Active state.

Lab Summary

This lab configuration included five routers with two ebgp routes at each end, with the three middle routers being ibgp plus ospf. This lab was in ipv4 using gns3. The loopback address are all /32 from 172.16.0.1|2 to 172.16.3.1|2 using loopback 0 to loopback 2 on the respected routers. The ibgp/ospf middle router’s ip addresses are 10.0.0.1|2/30 and 10.0.0.5|6/30, while the left ebgp router’s ip address is 20.0.0.1|2/30 and the right is 30.0.0.1|2/30. The AS# for the ibgp routers are 100, then the left is 200, and the right 300.

Lab Commands

**router bgp AS#** - enables bgp

**router ospf #** - enables ospf

**interface loopback#** - enables loopback interface

**network [network address] [wildcard mask] area #** - broadcasts network address with area #

**network [network address] mask [subnet mask]** - broadcasts network address

**neighbor [loopback address] mask [subnet mask]** - Broadcast connection to neighbor addresses

**neighbor [loopback address] remote-as [neighbor AS#]** - set neighbor as a member of remote AS #

**neighbor [loopback address] ebgp-multihop** - set neighbor on another network using ebgp multi-hop

**neighbor [loopback address] update-source [loopback interface]** - Forces bgp to use loopback address

**neighbor [neighbor address] route-reflector-client** -Configure the local router as the route reflector and the specified neighbor as one of its clients

**ip route [loopback address] [subnet mask] [outcoming/receiving interface]** - Configure static routes

**ping [address]** - Checks network connection between devices

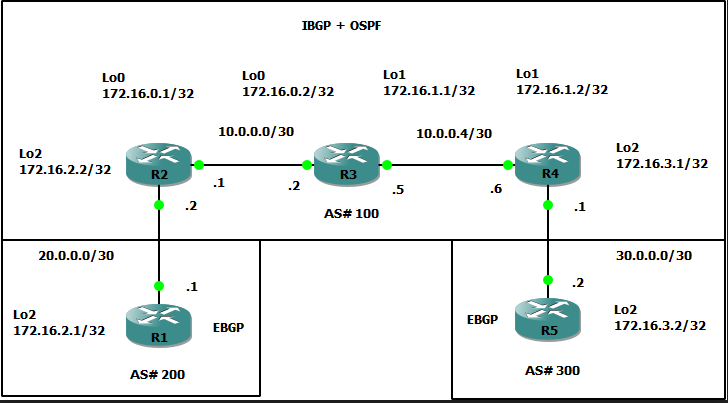
**show run** - Show configuration of selected device

**show ip route** - Shows routing table of selected device

**show ip bgp neighbo**r - Displays information between the TCP and BGP connections

**show ip bgp summary** - Display the status of all BGP connections

Topology



Configurations

**Router 1**

R1#show run

Building configuration...

Current configuration: 1670 bytes

!

hostname R1

!

interface Loopback2

ip address 172.16.2.1 255.255.255.255

!

interface GigabitEthernet1/0

ip address 20.0.0.1 255.255.255.252

negotiation auto

!

router bgp 200

bgp log-neighbor-changes

network 20.0.0.0 mask 255.255.255.252

neighbor 172.16.2.2 remote-as 100

neighbor 172.16.2.2 ebgp-multihop 255

neighbor 172.16.2.2 update-source Loopback2

!

ip route 172.16.2.2 255.255.255.255 20.0.0.2

!

end

R1#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, \* - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP + - replicated route, % - next hop override

Gateway of last resort is not set

10.0.0.0/30 is subnetted, 2 subnets

B 10.0.0.0 [20/0] via 172.16.2.2, 20:00:01

B 10.0.0.4 [20/0] via 172.16.2.2, 19:24:13

20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 20.0.0.0/30 is directly connected, GigabitEthernet1/0

L 20.0.0.1/32 is directly connected, GigabitEthernet1/0

30.0.0.0/30 is subnetted, 1 subnets

B 30.0.0.0 [20/0] via 172.16.2.2, 19:24:13

172.16.0.0/32 is subnetted, 7 subnets

B 172.16.0.1 [20/0] via 172.16.2.2, 20:00:01

B 172.16.0.2 [20/0] via 172.16.2.2, 19:24:13

B 172.16.1.1 [20/0] via 172.16.2.2, 19:24:13

B 172.16.1.2 [20/0] via 172.16.2.2, 19:24:13

C 172.16.2.1 is directly connected, Loopback2

S 172.16.2.2 [1/0] via 20.0.0.2

B 172.16.3.1 [20/0] via 172.16.2.2, 00:22:15

R1#show ip bgp neighbor

BGP neighbor is 172.16.2.2, remote AS 100, external link

BGP version 4, remote router ID 172.16.0.1

BGP state = Established, up for 20:00:06

Last read 00:00:38, last write 00:00:33, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 3 6

Keepalives: 1323 1315

Route Refresh: 0 0

Total: 1327 1322

Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast

Session: 172.16.2.2

BGP table version 18, neighbor version 18/0

Output queue size : 0

Index 1, Advertise bit 0

1 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 2 10 (Consumes 800 bytes)

Prefixes Total: 2 13

Implicit Withdraw: 0 0

Explicit Withdraw: 0 3

Used as bestpath: n/a 9

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 12 n/a

Total: 12 0

Number of NLRIs in the update sent: max 1, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 172.16.2.2

Connections established 1; dropped 0

Last reset never

External BGP neighbor may be up to 255 hops away.

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.2.1, Local port: 179

Foreign host: 172.16.2.2, Foreign port: 56062

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x4EA293C):

Timer Starts Wakeups Next

Retrans 1478 153 0x0

TimeWait 0 0 0x0

AckHold 1318 1290 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 0 0 0x0

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 1781056303 snduna: 1781081631 sndnxt: 1781081631 sndwnd: 15928

irs: 721250487 rcvnxt: 721275835 rcvwnd: 15928 delrcvwnd: 456

SRTT: 318 ms, RTTO: 429 ms, RTV: 111 ms, KRTT: 0 ms

minRTT: 44 ms, maxRTT: 4772 ms, ACK hold: 200 ms

Status Flags: passive open, gen tcbs

Option Flags: nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2961 (out of order: 0), with data: 1320, total data bytes: 25347

Sent: 2807 (retransmit: 153 fastretransmit: 0),with data: 1326, total data bytes: 25327

R1#show ip bgp summary

BGP router identifier 172.16.2.1, local AS number 200

BGP table version is 18, main routing table version 18

11 network entries using 1584 bytes of memory

12 path entries using 960 bytes of memory

3/3 BGP path/bestpath attribute entries using 408 bytes of memory

1 BGP AS-PATH entries using 24 bytes of memory

0 BGP route-map cache entries using 0 bytes of memory

0 BGP filter-list cache entries using 0 bytes of memory

BGP using 2976 total bytes of memory

BGP activity 14/3 prefixes, 15/3 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

172.16.2.2 4 100 1322 1327 18 0 0 20:00:14 10

**Router 2**

R2#show run

Building configuration...

Current configuration: 2094 bytes

!

hostname R2

!

interface Loopback0

ip address 172.16.0.1 255.255.255.255

!

interface Loopback2

ip address 172.16.2.2 255.255.255.255

!

interface GigabitEthernet1/0

ip address 10.0.0.1 255.255.255.252

negotiation auto

!

interface GigabitEthernet2/0

ip address 20.0.0.2 255.255.255.252

negotiation auto

!

router ospf 1

network 10.0.0.0 0.0.0.3 area 1

network 172.16.0.1 0.0.0.0 area 1

!

router bgp 100

bgp log-neighbor-changes

network 10.0.0.0 mask 255.255.255.252

network 20.0.0.0 mask 255.255.255.252

network 172.16.0.1

network 172.16.0.1 mask 255.255.255.255

network 172.16.2.2 mask 255.255.255.255

neighbor 172.16.0.2 remote-as 100

neighbor 172.16.0.2 update-source Loopback0

neighbor 172.16.2.1 remote-as 200

neighbor 172.16.2.1 ebgp-multihop 255

neighbor 172.16.2.1 update-source Loopback2

!

ip route 172.16.0.2 255.255.255.255 10.0.0.2

ip route 172.16.2.1 255.255.255.255 20.0.0.1

!

end

R2#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, \* - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP + - replicated route, % - next hop override

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

C 10.0.0.0/30 is directly connected, GigabitEthernet1/0

L 10.0.0.1/32 is directly connected, GigabitEthernet1/0

O 10.0.0.4/30 [110/2] via 10.0.0.2, 22:39:00, GigabitEthernet1/0

20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 20.0.0.0/30 is directly connected, GigabitEthernet2/0

L 20.0.0.2/32 is directly connected, GigabitEthernet2/0

30.0.0.0/30 is subnetted, 1 subnets

B 30.0.0.0 [200/0] via 172.16.1.2, 19:25:57

172.16.0.0/32 is subnetted, 7 subnets

C 172.16.0.1 is directly connected, Loopback0

S 172.16.0.2 [1/0] via 10.0.0.2

O 172.16.1.1 [110/2] via 10.0.0.2, 22:37:48, GigabitEthernet1/0

O 172.16.1.2 [110/3] via 10.0.0.2, 22:37:07, GigabitEthernet1/0

S 172.16.2.1 [1/0] via 20.0.0.1

C 172.16.2.2 is directly connected, Loopback2

B 172.16.3.1 [200/0] via 172.16.1.2, 00:24:14

R2#show ip bgp neighbor

BGP neighbor is 172.16.0.2, remote AS 100, internal link

BGP version 4, remote router ID 172.16.0.2

BGP state = Established, up for 19:26:19

Last read 00:00:23, last write 00:00:09, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 3 7

Keepalives: 1286 1282

Route Refresh: 0 0

Total: 1290 1290

Default minimum time between advertisement runs is 0 seconds

For address family: IPv4 Unicast

Session: 172.16.0.2

BGP table version 26, neighbor version 26/0

Output queue size : 0

Index 3, Advertise bit 0

3 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 5 7 (Consumes 560 bytes)

Prefixes Total: 5 9

Implicit Withdraw: 0 0

Explicit Withdraw: 0 2

Used as bestpath: n/a 6

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

ORIGINATOR loop: n/a 1

Bestpath from this peer: 8 n/a

Total: 8 1

Number of NLRIs in the update sent: max 4, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 172.16.0.2

Connections established 2; dropped 1

Last reset 19:26:20, due to Peer closed the session of session 1

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.0.1, Local port: 179

Foreign host: 172.16.0.2, Foreign port: 33360

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x5199F90):

Timer Starts Wakeups Next

Retrans 1432 144 0x0

TimeWait 0 0 0x0

AckHold 1286 1262 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 0 0 0x0

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 2762721835 snduna: 2762746483 sndnxt: 2762746483 sndwnd: 15144

irs: 2632407073 rcvnxt: 2632431906 rcvwnd: 14971 delrcvwnd: 1413

SRTT: 308 ms, RTTO: 363 ms, RTV: 55 ms, KRTT: 0 ms

minRTT: 32 ms, maxRTT: 3780 ms, ACK hold: 200 ms

Status Flags: passive open, gen tcbs

Option Flags: nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2862 (out of order: 0), with data: 1288, total data bytes: 24832

Sent: 2712 (retransmit: 144 fastretransmit: 0),with data: 1289, total data bytes: 24647

BGP neighbor is 172.16.2.1, remote AS 200, external link

BGP version 4, remote router ID 172.16.2.1

BGP state = Established, up for 20:01:38

Last read 00:00:41, last write 00:00:01, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 6 3

Keepalives: 1318 1325

Route Refresh: 0 0

Total: 1325 1329

Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast

Session: 172.16.2.1

BGP table version 26, neighbor version 26/0

Output queue size : 0

Index 2, Advertise bit 1

2 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 10 2 (Consumes 160 bytes)

Prefixes Total: 13 2

Implicit Withdraw: 0 0

Explicit Withdraw: 3 0

Used as bestpath: n/a 1

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 1 n/a

Total: 1 0

Number of NLRIs in the update sent: max 5, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 172.16.2.1

Connections established 1; dropped 0

Last reset never

External BGP neighbor may be up to 255 hops away.

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.2.2, Local port: 56062

Foreign host: 172.16.2.1, Foreign port: 179

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x5199F90):

Timer Starts Wakeups Next

Retrans 1495 173 0x0

TimeWait 0 0 0x0

AckHold 1326 1298 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 206272 206271 0x5199FBB

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 721250487 snduna: 721275892 sndnxt: 721275892 sndwnd: 15871

irs: 1781056303 rcvnxt: 1781081669 rcvwnd: 15890 delrcvwnd: 494

SRTT: 302 ms, RTTO: 315 ms, RTV: 13 ms, KRTT: 0 ms

minRTT: 44 ms, maxRTT: 888 ms, ACK hold: 200 ms

Status Flags: none

Option Flags: higher precendence, nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2965 (out of order: 0), with data: 1328, total data bytes: 25365

Sent: 2793 (retransmit: 173 fastretransmit: 0),with data: 1323, total data bytes: 25404

R2#show ip bgp summary

BGP router identifier 172.16.0.1, local AS number 100

BGP table version is 26, main routing table version 26

11 network entries using 1584 bytes of memory

13 path entries using 1040 bytes of memory

3/3 BGP path/bestpath attribute entries using 408 bytes of memory

1 BGP rrinfo entries using 24 bytes of memory

1 BGP AS-PATH entries using 24 bytes of memory

0 BGP route-map cache entries using 0 bytes of memory

0 BGP filter-list cache entries using 0 bytes of memory

BGP using 3080 total bytes of memory

BGP activity 11/0 prefixes, 20/7 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

172.16.0.2 4 100 1290 1290 26 0 0 19:26:31 7

172.16.2.1 4 200 1329 1325 26 0 0 20:01:50 2

**Router 3**

R3#show run

Building configuration...

Current configuration : 2123 bytes

!

hostname R3

!

interface Loopback0

ip address 172.16.0.2 255.255.255.255

!

interface Loopback1

ip address 172.16.1.1 255.255.255.255

!

interface GigabitEthernet1/0

ip address 10.0.0.5 255.255.255.252

negotiation auto

!

interface GigabitEthernet2/0

ip address 10.0.0.2 255.255.255.252

negotiation auto

!

router ospf 1

network 10.0.0.0 0.0.0.3 area 1

network 10.0.0.4 0.0.0.3 area 1

network 172.16.0.2 0.0.0.0 area 1

network 172.16.1.1 0.0.0.0 area 1

!

router bgp 100

bgp log-neighbor-changes

network 10.0.0.0 mask 255.255.255.252

network 10.0.0.4 mask 255.255.255.252

network 172.16.0.2

network 172.16.0.2 mask 255.255.255.255

network 172.16.1.1 mask 255.255.255.255

neighbor 172.16.0.1 remote-as 100

neighbor 172.16.0.1 update-source Loopback0

neighbor 172.16.0.1 route-reflector-client

neighbor 172.16.1.2 remote-as 100

neighbor 172.16.1.2 update-source Loopback1

neighbor 172.16.1.2 route-reflector-client

!

ip route 172.16.0.1 255.255.255.255 10.0.0.1

ip route 172.16.1.2 255.255.255.255 10.0.0.6

!

end

R3#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, \* - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP + - replicated route, % - next hop override

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks

C 10.0.0.0/30 is directly connected, GigabitEthernet2/0

L 10.0.0.2/32 is directly connected, GigabitEthernet2/0

C 10.0.0.4/30 is directly connected, GigabitEthernet1/0

L 10.0.0.5/32 is directly connected, GigabitEthernet1/0

20.0.0.0/30 is subnetted, 1 subnets

B 20.0.0.0 [200/0] via 172.16.0.1, 19:28:05

30.0.0.0/30 is subnetted, 1 subnets

B 30.0.0.0 [200/0] via 172.16.1.2, 19:27:51

172.16.0.0/32 is subnetted, 6 subnets

S 172.16.0.1 [1/0] via 10.0.0.1

C 172.16.0.2 is directly connected, Loopback0

C 172.16.1.1 is directly connected, Loopback1

S 172.16.1.2 [1/0] via 10.0.0.6

B 172.16.2.2 [200/0] via 172.16.0.1, 00:28:37

B 172.16.3.1 [200/0] via 172.16.1.2, 00:25:48

R3#show ip bgp neighbor

BGP neighbor is 172.16.0.1, remote AS 100, internal link

BGP version 4, remote router ID 172.16.0.1

BGP state = Established, up for 19:28:09

Last read 00:00:46, last write 00:00:02, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 7 3

Keepalives: 1284 1287

Route Refresh: 0 0

Total: 1292 1291

Default minimum time between advertisement runs is 0 seconds

For address family: IPv4 Unicast

Session: 172.16.0.1

BGP table version 22, neighbor version 22/0

Output queue size : 0

Index 2, Advertise bit 1

Route-Reflector Client

2 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 10 5 (Consumes 400 bytes)

Prefixes Total: 17 5

Implicit Withdraw: 5 0

Explicit Withdraw: 2 0

Used as bestpath: n/a 3

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 3 n/a

Total: 3 0

Number of NLRIs in the update sent: max 4, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 172.16.0.1

Connections established 2; dropped 1

Last reset 19:28:10, due to RR client config change of session 1

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.0.2, Local port: 33360

Foreign host: 172.16.0.1, Foreign port: 179

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x51CFBAC):

Timer Starts Wakeups Next

Retrans 1433 144 0x0

TimeWait 0 0 0x0

AckHold 1288 1269 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 197693 197692 0x51CFCB4

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 2632407073 snduna: 2632431944 sndnxt: 2632431944 sndwnd: 14933

irs: 2762721835 rcvnxt: 2762746502 rcvwnd: 15125 delrcvwnd: 1259

SRTT: 315 ms, RTTO: 400 ms, RTV: 85 ms, KRTT: 0 ms

minRTT: 36 ms, maxRTT: 3104 ms, ACK hold: 200 ms

Status Flags: none

Option Flags: higher precendence, nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2859 (out of order: 0), with data: 1290, total data bytes: 24666

Sent: 2721 (retransmit: 144 fastretransmit: 0),with data: 1290, total data bytes: 24870

BGP neighbor is 172.16.1.2, remote AS 100, internal link

BGP version 4, remote router ID 172.16.1.2

BGP state = Established, up for 19:27:55

Last read 00:00:18, last write 00:00:25, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 6 4

Keepalives: 1289 1284

Route Refresh: 0 0

Total: 1298 1289

Default minimum time between advertisement runs is 0 seconds

For address family: IPv4 Unicast

Session: 172.16.1.2

BGP table version 22, neighbor version 22/0

Output queue size : 0

Index 2, Advertise bit 1

Route-Reflector Client

2 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 10 5 (Consumes 400 bytes)

Prefixes Total: 17 5

Implicit Withdraw: 5 0

Explicit Withdraw: 2 0

Used as bestpath: n/a 3

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 3 n/a

Total: 3 0

Number of NLRIs in the update sent: max 4, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: 19:27:55

Last Sent Refresh End-of-rib: 19:27:55

Refresh-Out took 0 seconds

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 1 0

Refresh End-of-RIB 1 0

Address tracking is enabled, the RIB does have a route to 172.16.1.2

Connections established 2; dropped 1

Last reset 19:27:56, due to RR client config change of session 1

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.1.1, Local port: 52724

Foreign host: 172.16.1.2, Foreign port: 179

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x51CFBAC):

Timer Starts Wakeups Next

Retrans 1452 159 0x0

TimeWait 0 0 0x0

AckHold 1285 1256 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 199328 199327 0x51CFC8A

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 1201107676 snduna: 1201132660 sndnxt: 1201132660 sndwnd: 16289

irs: 3006560298 rcvnxt: 3006584959 rcvwnd: 15131 delrcvwnd: 1253

SRTT: 312 ms, RTTO: 390 ms, RTV: 78 ms, KRTT: 0 ms

minRTT: 32 ms, maxRTT: 5484 ms, ACK hold: 200 ms

Status Flags: none

Option Flags: higher precendence, nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2879 (out of order: 0), with data: 1287, total data bytes: 24660

Sent: 2720 (retransmit: 159 fastretransmit: 0),with data: 1295, total data bytes: 24983

R3#show ip bgp summary

BGP router identifier 172.16.0.2, local AS number 100

BGP table version is 22, main routing table version 22

12 network entries using 1728 bytes of memory

14 path entries using 1120 bytes of memory

4/2 BGP path/bestpath attribute entries using 544 bytes of memory

2 BGP AS-PATH entries using 48 bytes of memory

0 BGP route-map cache entries using 0 bytes of memory

0 BGP filter-list cache entries using 0 bytes of memory

BGP using 3440 total bytes of memory

BGP activity 12/0 prefixes, 23/9 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

172.16.0.1 4 100 1291 1292 22 0 0 19:28:22 5

172.16.1.2 4 100 1289 1298 22 0 0 19:28:07 5

**Router 4**

R4#show run

Building configuration...

Current configuration : 2075 bytes

!

hostname R4

!

interface Loopback1

ip address 172.16.1.2 255.255.255.255

!

interface Loopback2

ip address 172.16.3.1 255.255.255.255

!

interface GigabitEthernet1/0

ip address 30.0.0.1 255.255.255.252

negotiation auto

!

interface GigabitEthernet2/0

ip address 10.0.0.6 255.255.255.252

negotiation auto

!

router ospf 1

network 10.0.0.4 0.0.0.3 area 1

network 172.16.1.2 0.0.0.0 area 1

!

router bgp 100

bgp log-neighbor-changes

network 10.0.0.4 mask 255.255.255.252

network 30.0.0.0 mask 255.255.255.252

network 172.16.1.2 mask 255.255.255.255

network 172.168.3.1 mask 255.255.255.255

neighbor 172.16.1.1 remote-as 100

neighbor 172.16.1.1 update-source Loopback1

neighbor 172.16.3.2 remote-as 300

neighbor 172.16.3.2 ebgp-multihop 255

neighbor 172.16.3.2 update-source Loopback2

!

ip route 172.16.1.1 255.255.255.255 10.0.0.5

ip route 172.16.3.2 255.255.255.255 30.0.0.2

!

end

R4#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, \* - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP + - replicated route, % - next hop override

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

O 10.0.0.0/30 [110/2] via 10.0.0.5, 22:41:56, GigabitEthernet2/0

C 10.0.0.4/30 is directly connected, GigabitEthernet2/0

L 10.0.0.6/32 is directly connected, GigabitEthernet2/0

20.0.0.0/30 is subnetted, 1 subnets

B 20.0.0.0 [200/0] via 172.16.0.1, 19:28:46

30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 30.0.0.0/30 is directly connected, GigabitEthernet1/0

L 30.0.0.1/32 is directly connected, GigabitEthernet1/0

172.16.0.0/32 is subnetted, 7 subnets

O 172.16.0.1 [110/3] via 10.0.0.5, 21:09:15, GigabitEthernet2/0

O 172.16.0.2 [110/2] via 10.0.0.5, 22:40:31, GigabitEthernet2/0

S 172.16.1.1 [1/0] via 10.0.0.5

C 172.16.1.2 is directly connected, Loopback1

B 172.16.2.2 [200/0] via 172.16.0.1, 00:29:53

C 172.16.3.1 is directly connected, Loopback2

S 172.16.3.2 [1/0] via 30.0.0.2

R4#show ip bgp neighbor

BGP neighbor is 172.16.1.1, remote AS 100, internal link

BGP version 4, remote router ID 172.16.0.2

BGP state = Established, up for 19:28:53

Last read 00:00:53, last write 00:00:49, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 4 6

Keepalives: 1285 1290

Route Refresh: 0 0

Total: 1290 1299

Default minimum time between advertisement runs is 0 seconds

For address family: IPv4 Unicast

Session: 172.16.1.1

BGP table version 27, neighbor version 27/0

Output queue size : 0

Index 3, Advertise bit 0

3 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 5 7 (Consumes 560 bytes)

Prefixes Total: 5 8

Implicit Withdraw: 0 1

Explicit Withdraw: 0 0

Used as bestpath: n/a 6

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

ORIGINATOR loop: n/a 3

Bestpath from this peer: 7 n/a

Total: 7 3

Number of NLRIs in the update sent: max 3, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 2

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: 19:28:53

Last Received Refresh End-of-rib: 19:28:53

Refresh-In took 0 seconds

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 1

Refresh End-of-RIB 0 1

Address tracking is enabled, the RIB does have a route to 172.16.1.1

Connections established 2; dropped 1

Last reset 19:28:54, due to Peer closed the session of session 1

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.1.2, Local port: 179

Foreign host: 172.16.1.1, Foreign port: 52724

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x51C1BD8):

Timer Starts Wakeups Next

Retrans 1438 151 0x0

TimeWait 0 0 0x0

AckHold 1293 1265 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 0 0 0x0

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 3006560298 snduna: 3006584978 sndnxt: 3006584978 sndwnd: 15112

irs: 1201107676 rcvnxt: 1201132679 rcvwnd: 16270 delrcvwnd: 114

SRTT: 305 ms, RTTO: 342 ms, RTV: 37 ms, KRTT: 0 ms

minRTT: 32 ms, maxRTT: 3188 ms, ACK hold: 200 ms

Status Flags: passive open, gen tcbs

Option Flags: nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2881 (out of order: 0), with data: 1296, total data bytes: 25002

Sent: 2730 (retransmit: 151 fastretransmit: 0),with data: 1288, total data bytes: 24679

BGP neighbor is 172.16.3.2, remote AS 300, external link

BGP version 4, remote router ID 172.16.3.2

BGP state = Established, up for 19:48:29

Last read 00:00:38, last write 00:00:21, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 6 2

Keepalives: 1308 1308

Route Refresh: 0 0

Total: 1315 1311

Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast

Session: 172.16.3.2

BGP table version 27, neighbor version 27/0

Output queue size : 0

Index 2, Advertise bit 1

2 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 10 2 (Consumes 160 bytes)

Prefixes Total: 16 2

Implicit Withdraw: 6 0

Explicit Withdraw: 0 0

Used as bestpath: n/a 1

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 1 n/a

Total: 1 0

Number of NLRIs in the update sent: max 6, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 172.16.3.2

Connections established 1; dropped 0

Last reset never

External BGP neighbor may be up to 255 hops away.

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.3.1, Local port: 179

Foreign host: 172.16.3.2, Foreign port: 34018

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x51C1BFC):

Timer Starts Wakeups Next

Retrans 1472 160 0x0

TimeWait 0 0 0x0

AckHold 1309 1277 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 0 0 0x0

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 1194884309 snduna: 1194909551 sndnxt: 1194909551 sndwnd: 16023

irs: 628123783 rcvnxt: 628148776 rcvwnd: 16270 delrcvwnd: 114

SRTT: 307 ms, RTTO: 357 ms, RTV: 50 ms, KRTT: 0 ms

minRTT: 4 ms, maxRTT: 3520 ms, ACK hold: 200 ms

Status Flags: passive open, gen tcbs

Option Flags: nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2923 (out of order: 0), with data: 1310, total data bytes: 24992

Sent: 2765 (retransmit: 160 fastretransmit: 0),with data: 1313, total data bytes: 25241

R4#show ip bgp summary

BGP router identifier 172.16.1.2, local AS number 100

BGP table version is 27, main routing table version 27

11 network entries using 1584 bytes of memory

13 path entries using 1040 bytes of memory

3/3 BGP path/bestpath attribute entries using 408 bytes of memory

1 BGP rrinfo entries using 24 bytes of memory

1 BGP AS-PATH entries using 24 bytes of memory

0 BGP route-map cache entries using 0 bytes of memory

0 BGP filter-list cache entries using 0 bytes of memory

BGP using 3080 total bytes of memory

BGP activity 11/0 prefixes, 20/7 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

172.16.1.1 4 100 1300 1291 27 0 0 19:29:02 7

172.16.3.2 4 300 1311 1315 27 0 0 19:48:39 2

**Router 5**

R5#show run

Building configuration...

Current configuration : 1712 bytes

!

hostname R5

!

interface Loopback2

ip address 172.16.3.2 255.255.255.255

!

interface GigabitEthernet2/0

ip address 30.0.0.2 255.255.255.252

negotiation auto

!

router bgp 300

bgp log-neighbor-changes

network 30.0.0.0 mask 255.255.255.252

network 172.16.3.2 mask 255.255.255.255

neighbor 172.16.3.1 remote-as 100

neighbor 172.16.3.1 ebgp-multihop 255

neighbor 172.16.3.1 update-source Loopback2

!

ip route 172.16.3.1 255.255.255.255 30.0.0.1

!

end

R5#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, \* - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP + - replicated route, % - next hop override

Gateway of last resort is not set

10.0.0.0/30 is subnetted, 2 subnets

B 10.0.0.0 [20/0] via 172.16.4.1, 19:50:31

B 10.0.0.4 [20/0] via 172.16.4.1, 19:50:31

20.0.0.0/30 is subnetted, 1 subnets

B 20.0.0.0 [20/0] via 172.16.4.1, 19:31:08

30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 30.0.0.0/30 is directly connected, GigabitEthernet2/0

L 30.0.0.2/32 is directly connected, GigabitEthernet2/0

172.16.0.0/32 is subnetted, 7 subnets

B 172.16.0.1 [20/0] via 172.16.4.1, 19:31:08

B 172.16.0.2 [20/0] via 172.16.4.1, 19:50:31

B 172.16.1.1 [20/0] via 172.16.4.1, 19:50:31

B 172.16.1.2 [20/0] via 172.16.4.1, 19:50:31

B 172.16.2.2 [20/0] via 172.16.4.1, 19:31:08

S 172.16.3.1 [1/0] via 30.0.0.1

C 172.16.3.2 is directly connected, Loopback2

R5#show ip bgp neighbor

BGP neighbor is 172.16.3.1, remote AS 100, external link

BGP version 4, remote router ID 172.16.1.2

BGP state = Established, up for 19:50:36

Last read 00:00:41, last write 00:00:16, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:

1 active, is not multisession capable (disabled)

Neighbor capabilities:

Route refresh: advertised and received(new)

Four-octets ASN Capability: advertised and received

Address family IPv4 Unicast: advertised and received

Enhanced Refresh Capability: advertised and received

Multisession Capability:

Stateful switchover support enabled: NO for session 1

Message statistics:

InQ depth is 0

OutQ depth is 0

Sent Rcvd

Opens: 1 1

Notifications: 0 0

Updates: 2 6

Keepalives: 1311 1310

Route Refresh: 0 0

Total: 1314 1317

Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast

Session: 172.16.3.1

BGP table version 12, neighbor version 12/0

Output queue size : 0

Index 1, Advertise bit 0

1 update-group member

Slow-peer detection is disabled

Slow-peer split-update-group dynamic is disabled

Sent Rcvd

Prefix activity: ---- ----

Prefixes Current: 2 10 (Consumes 800 bytes)

Prefixes Total: 2 16

Implicit Withdraw: 0 6

Explicit Withdraw: 0 0

Used as bestpath: n/a 9

Used as multipath: n/a 0

Outbound Inbound

Local Policy Denied Prefixes: -------- -------

Bestpath from this peer: 9 n/a

Total: 9 0

Number of NLRIs in the update sent: max 2, min 0

Last detected as dynamic slow peer: never

Dynamic slow peer recovered: never

Refresh Epoch: 1

Last Sent Refresh Start-of-rib: never

Last Sent Refresh End-of-rib: never

Last Received Refresh Start-of-rib: never

Last Received Refresh End-of-rib: never

Sent Rcvd

Refresh activity: ---- ----

Refresh Start-of-RIB 0 0

Refresh End-of-RIB 0 0

Address tracking is enabled, the RIB does have a route to 172.16.3.1

Connections established 1; dropped 0

Last reset never

External BGP neighbor may be up to 255 hops away.

Transport(tcp) path-mtu-discovery is enabled

Graceful-Restart is disabled

Connection state is ESTAB, I/O status: 1, unread input bytes: 0

Connection is ECN Disabled

Mininum incoming TTL 0, Outgoing TTL 255

Local host: 172.16.3.2, Local port: 34018

Foreign host: 172.16.3.1, Foreign port: 179

Connection tableid (VRF): 0

Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)

Event Timers (current time is 0x4F0D7A0):

Timer Starts Wakeups Next

Retrans 1470 157 0x0

TimeWait 0 0 0x0

AckHold 1313 1279 0x0

SendWnd 0 0 0x0

KeepAlive 0 0 0x0

GiveUp 0 0 0x0

PmtuAger 203502 203501 0x4F0D7A4

DeadWait 0 0 0x0

Linger 0 0 0x0

iss: 628123783 snduna: 628148833 sndnxt: 628148833 sndwnd: 16213

irs: 1194884309 rcvnxt: 1194909589 rcvwnd: 15985 delrcvwnd: 399

SRTT: 310 ms, RTTO: 380 ms, RTV: 70 ms, KRTT: 0 ms

minRTT: 16 ms, maxRTT: 3088 ms, ACK hold: 200 ms

Status Flags: none

Option Flags: higher precendence, nagle, path mtu capable

Datagrams (max data segment is 1460 bytes):

Rcvd: 2930 (out of order: 0), with data: 1315, total data bytes: 25279

Sent: 2771 (retransmit: 157 fastretransmit: 0),with data: 1313, total data bytes: 25049

R5#show ip bgp summary

BGP router identifier 172.16.3.2, local AS number 300

BGP table version is 12, main routing table version 12

11 network entries using 1584 bytes of memory

12 path entries using 960 bytes of memory

3/3 BGP path/bestpath attribute entries using 408 bytes of memory

1 BGP AS-PATH entries using 24 bytes of memory

0 BGP route-map cache entries using 0 bytes of memory

0 BGP filter-list cache entries using 0 bytes of memory

BGP using 2976 total bytes of memory

BGP activity 11/0 prefixes, 12/0 paths, scan interval 60 secs

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd

172.16.3.1 4 100 1318 1314 12 0 0 19:50:45 10

Pings

**Router 1**

R1#ping 172.16.2.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms

R1#ping 172.16.2.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 80/91/120 ms

R1#ping 172.16.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 64/73/88 ms

R1#ping 172.16.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 216/236/280 ms

R1#ping 172.16.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 132/176/220 ms

R1#ping 172.16.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 268/320/376 ms

R1#ping 172.16.3.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 220/338/376 ms

R1#ping 20.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

R1#ping 20.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 48/76/100 ms

R1#ping 10.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 40/66/96 ms

R1#ping 10.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 112/186/332 ms

R1#ping 10.0.0.5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 136/171/204 ms

R1#ping 10.0.0.6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.6, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 228/299/380 ms

R1#ping 30.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 212/248/288 ms

R1#ping 30.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 272/401/544 ms

**Router 2**

R2#ping 172.16.2.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 28/109/144 ms

R2#ping 172.16.2.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

R2#ping 172.16.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/12 ms

R2#ping 172.16.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/81/144 ms

R2#ping 172.16.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 72/124/176 ms

R2#ping 172.16.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 156/216/292 ms

R2#ping 172.16.3.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 132/163/224 ms

R2#ping 20.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 76/107/136 ms

R2#ping 20.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/8 ms

R2#ping 10.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms

R2#ping 10.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 36/66/104 ms

R2#ping 10.0.0.5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 64/91/128 ms

R2#ping 10.0.0.6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.6, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 184/230/332 ms

R2#ping 30.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 148/192/232 ms

R2#ping 30.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 212/285/384 ms

**Router 3**

R3#ping 172.16.2.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 40/76/108 ms

R3#ping 172.16.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/65/88 ms

R3#ping 172.16.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

R3#ping 172.16.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/8 ms

R3#ping 172.16.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/86/144 ms

R3#ping 172.16.3.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 64/87/120 ms

R3#ping 20.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 140/202/276 ms

R3#ping 20.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 44/76/100 ms

R3#ping 10.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 68/89/124 ms

R3#ping 10.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/8 ms

R3#ping 10.0.0.5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

R3#ping 10.0.0.6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.6, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 52/76/104 ms

R3#ping 30.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 60/103/156 ms

R3#ping 30.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 144/178/244 ms

**Router 4**

R4#ping 172.16.2.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 120/192/296 ms

R4#ping 172.16.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 160/190/220 ms

R4#ping 172.16.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 88/121/144 ms

R4#ping 172.16.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/88/132 ms

R4#ping 172.16.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/3/8 ms

R4#ping 172.16.3.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms

R4#ping 172.16.3.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 36/75/128 ms

R4#ping 20.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 136/192/236 ms

R4#ping 10.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 136/183/272 ms

R4#ping 10.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 44/95/160 ms

R4#ping 10.0.0.5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 80/123/164 ms

R4#ping 10.0.0.6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.6, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms

R4#ping 30.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/8 ms

R4#ping 30.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 56/87/144 ms

**Router 5**

R5#ping 172.16.2.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.2.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 292/316/328 ms

R5#ping 172.16.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 236/337/460 ms

R5#ping 172.16.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 112/176/240 ms

R5#ping 172.16.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 148/198/216 ms

R5#ping 172.16.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 64/103/168 ms

R5#ping 172.16.3.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 20/74/124 ms

R5#ping 172.16.3.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.16.3.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms

R5#ping 20.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 20.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 216/299/424 ms

R5#ping 10.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 252/333/444 ms

R5#ping 10.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 144/201/228 ms

R5#ping 10.0.0.5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.5, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 100/163/208 ms

R5#ping 10.0.0.6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.0.0.6, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 68/111/160 ms

R5#ping 30.0.0.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 72/112/152 ms

R5#ping 30.0.0.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

Problems

The obvious problem was how to connect the ebpg to the ibpg + ospf without using redistribution. It was a new learning topic of using the loopback and not the physical interface. Used the links, urls, and pdfs that Mr. Mason supplied us with an almost one to one scale guide to the actual lab. Use commands from previous labs like the route reflector client on the mid ibgp route allowing access to the other network of the ebgp to connect. Another problem was with the activity of the bgp connection between ebgp and ibgp. Figuring out how to get the connection to be established and not active or idle. After a few classes, it was brought up that some people used and needed to add static routes from the ebgp loopback to the ibgp loopback to enable establishment on the route. Worked right after adding the static routes to each ebgp and ibgp border routers.

Conclusions

In conclusion, this lab allowed us to combine the past labs into a whole different lab with using loopbacks as the different aspect. Without using redistribution as the connection between bgp and ospf, using the loopback was the new concept that was added for this lab. Figuring out the logic behind the use of loopback verse the interfaces and the signs that there is functional connection.